

CLAIMS

What is claimed is:

1. An irrigation system (10) for conveying a fluid to a region (A) having a main boundary (M) and an outer boundary (B) outlying the main boundary (M), said system comprising:
 - a center pivot (13),
 - a main irrigation portion (16) having a proximal end at said center pivot (13) and radially extending to a distal end for rotation about said center pivot (13) to irrigate the region (A) within the main boundary (M),
 - a corner irrigator span (42) coupled to said main irrigation portion (16) and radially extending from said distal end of said main irrigation portion (16) for irrigating the region (A) between the main boundary (M) and the outer boundary (B),
 - a drive system for moving said main irrigation portion (16) about said center pivot (13) and along the main boundary (M),
 - a corner drive system (70) for moving said corner irrigator span (42) with said main irrigation portion (16) and along the outer boundary (B),
 - a first electrical generator (102) operative between said corner irrigator span (42) and said main irrigation portion (16) for generating a first control signal representing an operating angle (α) between said corner irrigator span (42) and said main irrigation portion (16) whereby the first control signal varies as the operating angle (α) varies,
 - a second electrical generator (104) coupled to said main irrigation portion (16) for generating a second control signal representing a primary control position (P) of said main irrigation portion (16) whereby the second control signal varies as the primary control position (P) varies, and
 - a controller (100) programmed for receiving said control signals and controlling said corner drive system (70) based on said control signals to maintain a target operating angle between said corner irrigator span (42) and said main irrigation portion (16) to ensure that said corner irrigator span (42) follows along the outer boundary (B),

said system characterized by said second electrical generator (104) being a position determining sensor (104) for sensing a reference signal to determine the primary control position (P) of said main irrigation portion (16).

2. An irrigation system (10) as set forth in claim 1 wherein said position determining sensor (104) is further defined as an electronic compass (104).

3. An irrigation system (10) as set forth in claim 2 wherein said main irrigation portion (16) comprises a plurality of irrigator spans (14) interconnected in an end-to-end manner and said electronic compass (104) is fixed to one of said irrigator spans (14).

4. An irrigation system (10) as set forth in claim 3 wherein said plurality of irrigator spans (14) include an end irrigator span (44) at said distal end of said main irrigation portion (16) and said first electrical generator (102) operates between said end irrigator span (44) and said corner irrigator span (42) to generate the first control signal.

5. An irrigation system (10) as set forth in claim 4 wherein said electronic compass (104) is fixed to said end irrigator span (44).

6. An irrigation system (10) as set forth in claim 5 further including a third electrical generator (106) coupled to said main irrigation portion (16) for generating a third control signal representing a secondary control position (S) of said main irrigation portion (16) whereby the third control signal varies as the secondary control position (S) varies.

7. An irrigation system (10) as set forth in claim 6 wherein said corner drive system (70) includes a steering unit (74) and a corner drive unit (72).

8. An irrigation system (10) as set forth in claim 7 further including a

fourth electrical generator (108) responsive to said steering unit (74) for generating a fourth control signal representing a steering angle (Ψ) of said steering unit (74).

9. An irrigation system (10) as set forth in claim 8 wherein said controller (100) is programmed for receiving the control signals and controlling said steering unit (74) based on the control signals to maintain movement of said corner irrigator span (42) along the outer boundary (B).

10. An irrigation system (10) as set forth in claim 9 wherein said drive system is further defined as a plurality of drive systems (20) for moving each of said plurality of irrigator spans (14) of said main irrigation portion (16) about said center pivot (13).

11. An irrigation system (10) as set forth in claim 10 further including an electrical generator (96) operative between said end irrigator span (44) and said corner irrigator span (42) for generating a control signal representing linear movement of said corner irrigator span (42) relative to said end irrigator span (44) whereby the control signal varies as a linear distance between said corner irrigator span (42) and said end irrigator span (44) varies.

12. An irrigation system (10) as set forth in claim 11 wherein said electrical generator (96) operative between said end irrigator span (44) and said corner irrigator span (42) is further defined as a potentiometer (96).

13. An irrigation system (10) as set forth in claim 12 wherein said corner drive unit (72) comprises a corner variable frequency drive module (80) and at least one corner drive motor (76) having variable speed and said corner variable frequency drive module (80) receives the control signal from said potentiometer (96) to vary the speed of said at least one corner drive motor (76).

14. An irrigation system (10) as set forth in claim 8 wherein said first

(102), third (106), and fourth (108) electrical generators are further defined as angle resolvers.

15. An irrigation system (10) as set forth in claim 8 wherein said first (102) and fourth (108) electrical generators are further defined as angle resolvers and said third electrical generator (106) is further defined as an electronic compass (106).

16. A method of controlling an irrigation system (10) comprising a main irrigation portion (16) coupled to a center pivot (13) and a corner irrigator span (42) extending radially from the main irrigation portion (16), said method comprising the steps of;

moving the main irrigation portion (16) and the corner irrigator span (42) about the center pivot (13) in an operating mode,

determining a plurality of current values for an operating angle (α) between the main irrigation portion (16) and the corner irrigator span (42) as the main irrigation portion (16) and the corner irrigator span (42) move about the center pivot (13) in the operating mode,

sensing a reference signal as the main irrigation portion (16) and the corner irrigator span (42) move about the center pivot (13) in the operating mode,

determining a plurality of current values for a primary control position (P) from the sensed reference signal as the main irrigation portion (16) and the corner irrigator span (42) move about the center pivot (13) in the operating mode, and

automatically controlling the steering unit (74) based on the plurality of current values for the operating angle (α) and the primary control position (P).

17. A method as set forth in claim 16 further including determining a plurality of current values for a secondary control position (S) from the sensed reference signal as the main irrigation portion (16) and the corner irrigator span (42) move about the center pivot (13) in the operating mode and automatically controlling the steering unit (74) based on the plurality of current values for the operating angle (α) and the primary (P) and secondary (S) control positions.

18. A method as set forth in claim 17 further including moving the main irrigation portion (16) and the corner irrigator span (42) about the center pivot (13) in a teaching mode prior to the operating mode and compiling a plurality of initial values for the operating angle (α) and the primary (P) and secondary (S) control positions in a look-up table in the teaching mode.

19. A method as set forth in claim 18 further including steering the corner irrigator span (42) about the center pivot (13) as the corner irrigator span (42) moves about the center pivot (13) in the teaching mode and compiling a plurality of initial values of a steering angle (Ψ) of the steering unit (74) of the corner irrigator span (42) in the look-up table while the steering unit (74) steers the corner irrigator span (42) about the center pivot (13) in the teaching mode.

20. A method as set forth in claim 19 further including comparing the plurality of current values determined in the operating mode with the plurality of initial values compiled in the teaching mode and determining a target operating angle from the look-up table based on the comparison.

21. A method as set forth in claim 20 further including automatically steering the steering unit (74) in a direction toward achieving the target operating angle.

22. A method as set forth in claim 21 further including determining a target steering angle from the look-up table that corresponds to the determined target operating angle and steering the steering unit (74) to the target steering angle upon achieving the target operating angle.